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ABSTRACT

Focusing on ways to teach fourth-grade students the machine skills they need to make the computer a fluent writing tool, this study sought to identify the word processing skills that students need to learn and the ones that are most difficult, and the instructional approaches that work best in teaching word processing skills. The problems and solutions presented in this paper draw on weekly observations of writing sessions with both normally achieving and learning disabled children in four 4th grade classrooms, together with ongoing conversations with their teachers. Preliminary findings indicate that word processing skills may be too difficult for elementary school children to learn, but it is suggested that this conclusion may be premature. While the research identifies the problems of acquiring word processing skills, it also illuminates several factors that contribute to student's difficulties and points to some practical directions for teaching word processing skills more effectively. These factors are: (1) simultaneous attention to writing and word processing; (2) interference of keyboarding problems; (3) lack of systematic monitoring and follow-up; (4) premature teaching of advanced editing skills; (5) teacher inexperience with computer software and management; (6) software weaknesses; and (7) a research artifact (requiring students to save each day's work). An approach to teaching machine skills based on these findings is suggested, including several general guidelines and a model for balancing attention to writing and word processing. The text is supplemented by two graphs and one figure. (13 references) (EW)

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"I've Lost My Story!"
Integrating Word Processing with Writing Instruction

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We wish to acknowledge the associate teachers whose experiences contributed immeasurably to this paper: Norma Ciccarelli and Sharon Risso (Watertown Public Schools); Kitty Boles, Frances K. Morse, and Vivian Troen (Brookline Public Schools); and Stephen Greene and Sharon Herman (Concord Public Schools).

"My story won't retrieve!" "How do we save it?" Weeks after our fourth-grade teachers hoped to be focused on writing, many students were still struggling with (or playing with) the machine--their writing tool. One of our biggest concerns this year in the Writing Project[1] has been how to teach fourth-grade students the machine skills they need to make the computer a fluent writing tool. Although research suggests this new technology can benefit young writers (Daiute, 1985; Daiute & Kruidenier, 1985; Morocco & Neuman, 1986), only sporadic attention has been given to the teaching of keyboarding (Jackson & Berg, 1986; Wetzel, 1985; Neuman & Morocco, 1987) and word-processing skills (Balajthy, McKeveny, & Lacitignola, 1986-87; Boudrot, 1986; Joslin, 1986).

We found that the teaching of "machine skills" emerged as a critical issue for our teachers. Despite basic differences in their philosophies and methods of teaching writing and word processing, all our teachers felt a common need at year's end to develop a <u>better</u> way to prepare their students for writing on the computer. This paper responds to that need, addressing two questions:

- What word-processing skills do students need to learn, and which ones are the most difficult?
- What instructional approaches work best in teaching word-processing skills?

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[1] The Writing Project is an ongoing research project funded by the Office of Special Education Programs to investigate the effects of computers on the writing development of learning-disabled and normally achieving fourth-grade students. In this phase, the study is taking place in three diverse school districts in Eastern Massachusetts. In addition to the five classroom teachers, a computer specialist and a special needs teacher participate in the project.

The problems and solutions presented draw on weekly observations of writing sessions in four 4th-grade classrooms and ongoing conversations with the five participating teachers (two of whom were team-teaching) in three schools. The teachers used a process approach to writing and were considered excellent teachers by their school systems. The student sample included both normally achieving and learning- disabled children. We used a modified time-sampling approach to focus alternately on the teacher and two selected students during each writing period. All students used the computer for writing for two to three periods per week, from November through May. Computer facilities varied among the sites: One class wrote on computers in a lab, another class wrote on computers in their classroom, and the third used computers in both lab and classroom settings.

This paper is organized in two sections, each addressing one of the questions above. First, we discuss the problem of learning word- processing functions and some factors that can exacerbate the problem. Second, we recommend an approach to teaching word-processing skills.

The Problem of Learning Word Processing Skills

Persisting Troubles

All our teachers devoted some specific attention to teaching such basic word-processing features as cursor movement, wraparound, backward delete, insert, and file management (save, retrieve, and print). However, the amount of time and type of instruction varied widely among the three sites: Two teachers taught a sequence of group lessons, demonstrating how to use a specific word-processing function and then prompting students

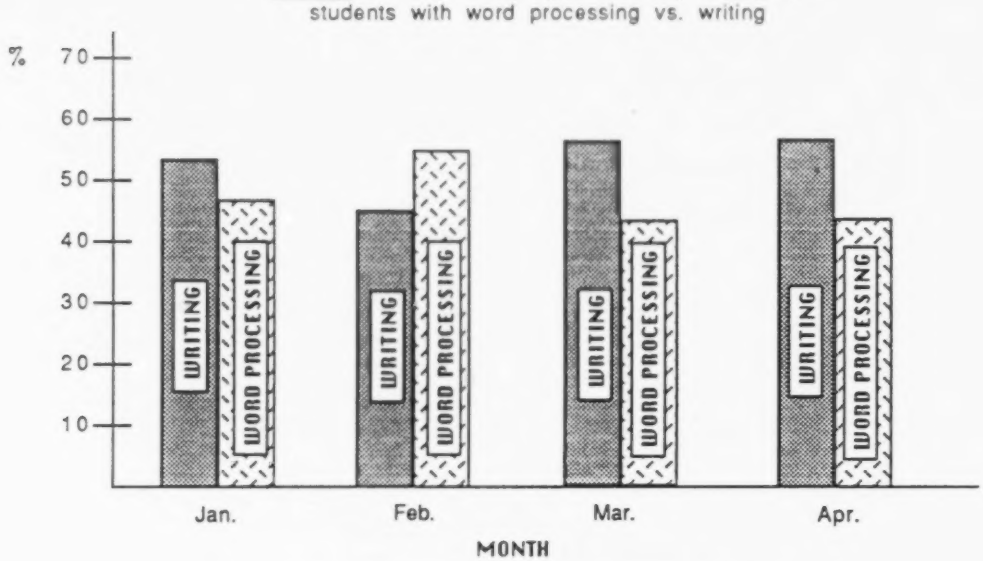
through the procedure as they practiced on their own computers; one teacher taught the skills briefly and informally during the first week; and two other teachers helped students with word-processing skills as the need arose but left systematic instruction to the school's computer specialist, who taught the students once a week for approximately 3 months. Regardless of how teachers approached word-processing skills, the "machine" remained a major preoccupation for students well into the spring.

Our observation data revealed this persisting focus on machine skills. To analyze these data, we developed a coding scheme to classify the teacher and student interactions and behaviors we recorded during our weekly observation sessions. Teacher interactions were categorized as relating to either writing or word processing, and events in the latter category were further identified by the specific word-processing skill involved. Students' evidence of difficulty with machine skills was also categorized by the specific skill involved and included instances in which the students got help from teachers and peers, as well as instances in which they did not get help. Teacher codings included the classroom teacher and the special needs and computer resource teachers when they were present. Teacher codings also included us, since students occasionally requested help from the observers and we responded to those requests, documenting and including these "participant-observer events" as part of our data.

Each class session was coded by the researcher present during the observation and then checked by another researcher. All disagreements were discussed and reconciled between the two researchers. Percentages were computed based on the total number of events coded. It's important to note that this analysis does not include the class time spent on writing instruction when computers were not being used.

Graph 1 shows that teachers using a computer lab for writing gave just about the same amount of attention to word-processing skills in April as they did in January. Most of the help teachers gave was in the form of troubleshooting--responding to individual problems while students were writing on the computer. This kind of individualized help with machine skills left relatively little time to focus on the process and content of students' actual writing during writing lab sessions.

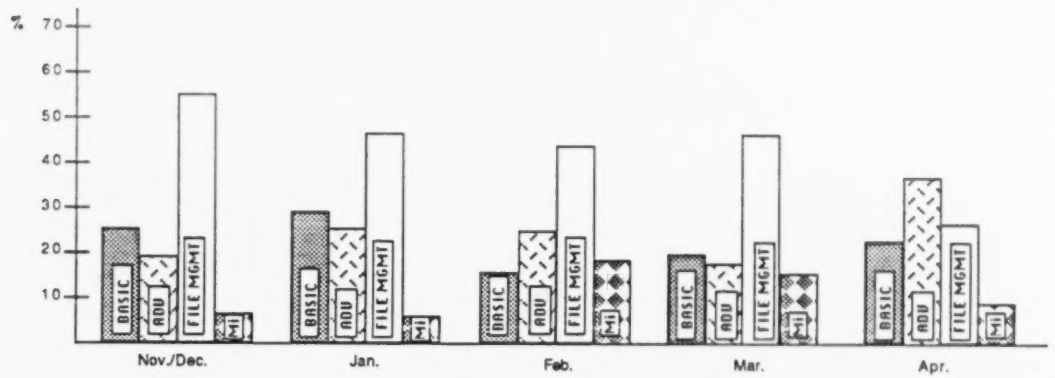
Graph 1. Teacher time* spent teaching or helping students with word processing vs. writing



*Based on 461 observation codings in 3 computer lab settings.

Graph 2 illustrates more specifically what word-processing skills remained difficult for students throughout the winter and spring. The most basic word-processing skills (insert, delete, return, and cursor movement) continued to pose difficulty, though at a declining rate, throughout the year. Those skills which were the most dramatically difficult for students are the basic file management functions of save, retrieve, clear, and print. In November and December, 54% of the events coded as instances of difficulty pertained to file management; these problems persisted at a level of 43%-46% during the next 3 months and did not appreciably decline until April, when they reached a low of 28%. Students' difficulty with file management appeared to stem in part from a conceptual problem--understanding what happened to their writing once they typed it on the keyboard. They were confused about how and where files were saved and resaved on data disks, and as a result, they occasionally lost their stories or saved multiple copies of the same story.

Graph 2. Evidence of student difficulty with word processing



Basic: keyboarding, shift-n caps, return/wraparound, backspace delete, space bar, move cursor
File Management: handling disk/booting up, retrieve, save, change modes, print, clear screen
Advanced Editing: delete from cursor, insert from cursor, typeover, block move, block erase, find/replace,
Misc.: center, new page, tab/indent, go beginning/end, formatting, fonts

*Based on 338 observation codings in 3 computer labs and 1 classroom setting

Problems with advanced editing features ranged from a low of 13% in November/December to a high of 39% in April and reflect not only students' learning of new skills but also their continued difficulty with previously introduced skills. For example, in the first month or two of the project, students relied on backspace delete to make changes in their text. By January and February, many students had progressed to using insert/delete from the cursor but were inefficient in their use, inserting extra space or deleting words and phrases unintentionally. The relatively high percentage of difficulty in April reflects these student inefficiencies, as well as one class' attempts to use the block move function, an advanced skill introduced to them in March. We consider the latter evidence of difficulty productive, since it shows that students were working to acquire a complex word-processing skill directly related to higher level revision goals. In contrast, students' weak command of the insert/delete from cursor procedure reflects an incomplete understanding of how to perform the function.

Formatting and publication features were not a problem for students in the early months, when texts were short and teachers' expectations fairly lenient. However, as texts lengthened and there was more of a focus on the "look" of the published product, students needed to know how to indent paragraphs, center titles, and format spacing for special types of writing, such as poetry. Manipulating space in their text was a problem for many students who relied on the space bar to center titles or to begin a new paragraph, since the printout did not correspond to the screen layout. Inadvertently hitting return and then not knowing how to get rid of the extra space was also a problem.

In sum, our teachers wanted to focus primarily on writing issues after an initial period of teaching machine skills; instead,

they continued to spend a major portion of their time teaching and troubleshooting machine skills until the end of the school year. Skills that students were using continually to manage their work and benefit from the computer as a writing tool--the ability to write, save, retrieve, expand or revise, save, retrieve again, and so forth--remained particularly difficult.

These findings are critical, for if word-processing skills are indeed difficult for fourth-graders to learn and require a substantial investment of teacher and student time, word processing may be inappropriate in the upper elementary grades. But in fact, this conclusion is premature, for while the research points out the problems of acquiring word-processing skills, it also illuminates several factors that contribute to students' difficulties and point to some practical directions for teaching word- processing skills more effectively.

Contributing Factors

Simultaneous attention to writing and word processing. At our request, all teachers introduced word processing simultaneously with having students write "on-line" journals. While we had assumed that journal writing would be a relatively easy and "natural" task for students, we were mistaken. Only one of our five teachers involved students in journal writing on a regular basis and felt entirely comfortable facilitating this type of writing. Because it was not a familiar kind of writing and they lacked strategies for generating ideas, some students devoted equal attention to managing the writing task and managing the word-processing software. As a result, they were only partially learning the basic word- processing skills.

Interference of keyboarding problems. Only two of the five teachers taught students keyboarding prior to the beginning of their computer writing program, with occasional reviews

throughout the year; by April and May these students had become the most proficient typists and wrote on the computer with relative ease. Although students who received no direct instruction appeared fairly competent on the keyboard during the first few months of the project, when writing assignments were relatively short, their weak typing skills became evident during the latter part of the year when they began to write more extended pieces on the computer. Frustrated by their inability to type quickly and accurately, some students bemoaned the fact that it took so long to write on the computer--writing longhand in their themebooks was a pleasant alternative since their fluency was unimpeded by their weak typing skills.

Lack of systematic monitoring and follow-up. Because their main interest was in the writing program, teachers did not monitor individual students' progress with machine skills or reteach skills if students did not grasp them initially. As a result, some basic misperceptions about file management functions and the manipulation of space in text persisted, and students often relied on workable but inefficient strategies for composing and revising through the remainder of the year. For example, students who did not fully understand the delete procedure often erased and typed over a whole sentence, rather than revising just a part of it.

Premature teaching of advanced editing skills. Teachers sometimes showed students advanced editing skills before students could actually absorb them or were ready to use them in their own writing. One teacher taught students tab and center very early on, and although they did not actually need these functions at the time, some students became preoccupied with trying to use them. Their misconceptions about the manipulation of space were further confounded by the premature teaching of these additional formatting functions. In another example, a group of students

completed an early exercise in block move but never applied it to their own writing. In contrast, another group of students who learned this advanced function when they were writing and conferencing extensively and who received direct instruction in how and why block move can help reorganize text applied it independently in the months that followed. Given direct instruction in both writing and word processing skills at a point when those skills were emergent in their own wriitng, students exercised complex, content-level revisons of their writing.

Teacher inexperience with computer software and management. Some of students' difficulty with machine skills can be attributed to teachers' inexperience in managing a computer-based writing environment and using their school's word-processing software. Monitoring of students' word- processing skills was difficult for those teachers who were also learning how to use the software and developing new systems for getting students on and off the computers, booting up equipment, printing hard copies, and storing students' data disks. Expressing several teachers' early frustration with learning software and management strategies simultaneously, one teacher cried, "I feel like I'm teaching fourth-grade reading and I can't even read at the fourth-grade level!" Once teachers have learned the software and developed management routines, they should be able to respond more efficiently to students' problems with software and pinpoint common problems that require whole class instruction or review.

Software weaknesses. File management difficulties were also attributable to the software used in the four classrooms. Students in the three classes using Bank Street Writer had far more difficulty retrieving and saving their files than those in the class using Magic Slate, a program that uses icons to represent file management functions. In addition, Magic Slate files are retrieved

by selecting a highlighted file name rather than by typing in the file name, a procedure that caused problems for students who mistyped their file name and thought they had lost their file when the program did not retrieve it.

Research artifact. Some part of students' difficulty with file management can probably be attirbuted to our requirement that students file each day's work under a new file name. Saving drafts under separate file names is a more complex task than simply replacing the original file with a revised one.

Together, these seven factors exacerbated the demands of leanring new machine skills and contributed particularly to students' difficulty in grasping file managment procedures. All these problems are, however, correctable. They underscore the need to develop an approach to teaching word-processing skills that takes these factors into account, if we are to reduce the amount of student difficulty and teacher time related to the acquisition of these skills.

A Recommended Approach

On the basis of these findings, we recommend an approach to teaching machine skills that includes several general guidelines and a model for balancing attention to writing and word processing. This section presents the guidelines and the model, including an example of how the model would be implemented.

Guidelines

- Teach keyboarding for a minimum of 3 weeks, with short, frequent practices, prior to any teaching of word-processing skills. Keyboarding software should sequence and pace instruction, provide feedback on progress, and separate instruction from speed drills.

• Follow keyboarding practice with 4 to 6 weeks' teaching of carefully monitored basic word-processing skills. Whether students begin word processing in the third grade or the seventh, this intensive period of basic word-processing instruction is probably a necessary and important one-time investment of effort for students and teachers. These skills should include typing text and using backspace delete, insert/delete from cursor, hard return, and basic file management functions. These functions can be taught in the context of simple but engaging language arts activities.

• Introduce advanced revising and editing skills as they are required to accomplish specific writing objectives. These skills include block move, find and replace, block erase and copy. Advanced formatting skills for publication, such as center, tab, and special fonts, can also be introduced as students need them to polish a piece for publication.

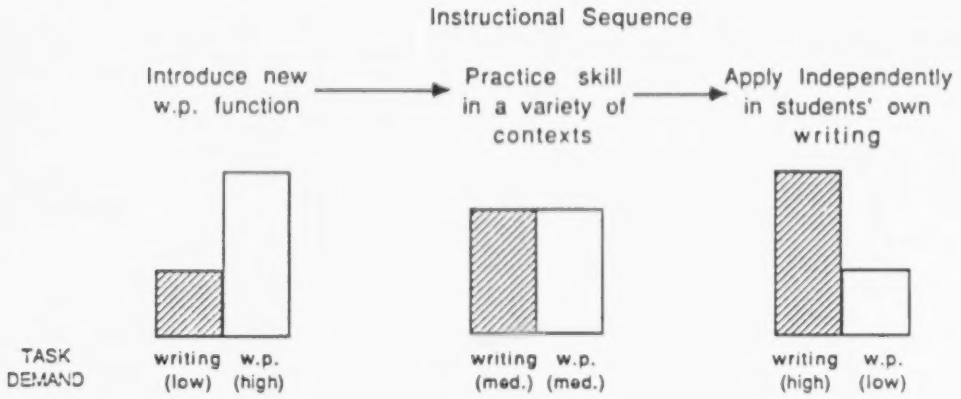
A Model for Integrating Writing Objectives with Machine Skills

A repeated theme in our findings is that we cannot overload students with complex writing demands when they are learning new machine skills. As our project's computer specialist describes it, children's writing performance "dips" whenever they learn a new word-processing skill. Information-processing theory (LaBerge & Samuels, 1974; Simon, 1976) offers an appealing explanation for this dip. The introduction of a new word-processing skill places additional demands on the writer, requiring that she or he now attend to both the writing task and the word- processing task. This may overload the student's processing capacity, resulting in a temporary decline in writing performance while attention is concentrated on learning the new word-processing skill. As the writer moves from an effortful stage of skill acquisition to a more

fluent stage of independent skill application, he or she is able to gradually increase the attention given to the writing task.

The model is represented below. Its guiding principle is: DON'T OVERLOAD!

Integrating word processing and writing: A balancing of task demands


Instructional Sequence
Introduce new w.p. function
Practice skill in a variety of contexts
Apply Independently in students' own writing
TASK DEMAND
writing (low) w.p. (high)
writing (med.) w.p. (med.)
writing (high) w.p. (low)

The model presents three stages of teaching/learning: (a) introducing the skill, (b) providing extended practice, and (c) promoting independent and eventually fluent application in the students' own writing. The bar graph shows the balance between the attention allocated to the writing task versus the word-processing task at each stage. This balance changes across the three stages. The three stages are described below and illustrated by using block move as an example.

Stage 1: introduction (low writing demand/high word processing demand) In Stage 1, students' attention is focused on learning a new word- processing skill. The writing activity should be fun and simple, so that students are engaged but are not expending a great deal of effort handling the writing task. If this isn't the case, students' writing performance may temporarily dip while they concentrate on the word-processing skill, or they may do poorly on both the writing and the word-processing tasks.

Example: The previous discussion indicates that an advanced revising feature such as block move should be taught when students are in fact ready to improve the focus of their writing through major reorganization. When students are writing fairly lengthy drafts and are learning to conference with the teacher and other students about the focus and organization of their writing, introducing the block move function on the computer can highlight and "objectify" this writing skill and stimulate revision.

Have students put their own writing aside for a day. Introduce block move through a simple writing activity that allows students to focus mainly on the machine skill. You can give students a disk with scrambled nursery rhymes (low writing demand, typing eliminated). If students are not familiar with the rhyme (we found that recently immigrated students frequently were not), write it on the board in the correct order. First demonstrate the block move procedure, using a large screen if available, and then prompt students through reordering the rhyme (high word- processing demand).

Stage 2: practice (medium writing demand/medium word-processing demand) In Stage 2, the writing and word-processing demands are more balanced. As students gain familiarity with the new function, they expend less effort on the word-processing task and are able to take on more challenging writing tasks. Because

students will vary in the amount of practice and types of support needed, monitoring of individual progress is critical at this stage. Students who are having difficulty must receive help if they are to achieve the basic level of competence prerequisite to the next stage of independent application.

Continuing example: After the introductory session described in Stage 1, students will have some familiarity with the block move function but are likely to be expending considerable effort on the word- processing task. They can increase their skill by exercising the function within increasingly challenging contexts. One helpful exercise is to give students a disk with a set of directions out of order; they will need to think about the approriate sequence of actions prior to using block move. A more challenging activity would be a narrative paragraph, with events out of order.

Stage 3: independent application in student writing (high writing demand/low word-processing demand) At this stage, students are developing independence and fluency in their use of the word-processing skill. They know the purpose of the function and how to use it in their own composing and revising. The challenge during this stage is in the writing task, since students are independently evaluating and revising their own work. Although independent application is effortful at first, repeated practice will eventually lead to automaticity of the word-processing skills involved.

Continued example: Students who now know how to use block move when they want to reorganize their text, could begin using the function in their own writing. Here, students should return to their own writing and use conferencing partners to evaluate whether their writing is sequenced in an order that fits their writing plan and goal. Initially, teachers may need to remind students that they can use the block move to try a different text ordering.

Conclusion

Integrating computers with a writing process program is a formidable task for teachers of young writers. Our experience this year clearly indicates that teachers must be prepared to devote a substantial part of their time to teaching keyboarding and word-processing skills if their students are to become fluent writers on the computer. Although students given minimal instruction will function, they will do so at a level that eventually interferes with the writing goals inherent in a writing process program.

If the potential of the technology to support and develop students' writing abilities is to be fully exploited, a mimimum level of "machine" competency is essential. Our teachers demonstrated that fourth-graders are capable of using advanced editing features (such as block move) to improve the quality of their writing, but only when given direct instruction and practice in both the word-processing skill and the writing task. Students who did not receive this type of direct instruction generally did not use the revision capabilities of the computer beyond simple editing corrections.

We have redesigned our program for the second year of the Writing Project, building on the lessons of the past year and incorporating our ideas about how young students learn and develop as writers in a computer writing environment. In collaboration with our teachers, we have designed a word-processing curriculum that provides systematic instruction of basic and advanced skills to support a writing process program. We also have written a short play, Where's the Writing?, to help our students conceptualize the basic operations of file management. During the next year, we will be evaluating the impact of our revised program

and will be focusing on how teachers adapt model writing units and word-processing instruction to help students with highly diverse learning needs.

Through these gradual steps, which integrate research and practice, we hope to maximize the support that computers can provide to students as they learn the complex and enormously important craft of writing.

For more information, contact The Writing Project, Education Development Center, Inc., Newton, MA 02160.

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